STRONGYLOIDES STERCORALIS, WITH REPORT OF THREE CASES FROM TENNESSEE.

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It has not been many years since the examination of stools by the general practitioner was almost unheard of. Even today it is unfortunately not a routine practice in all cases with bowel symptoms, but it is far more general than formerly, and those who make use of microscopical examination of the stools have fewer cases of "mistaken diagnosis" to record than do those whose far-seeing clinical eye enables them to diagnose from symptoms alone their cases of bowel disturbance.

While the purpose of this paper is to place on record three additional cases of infection with the strongyloides stercoralis, it may not be amiss to refer briefly to the method of examination of the feces. No elaborate equipment is necessary. A microscope with ordinary low and high power dry lenses, slides and coverslips and conical sedimentation glasses are all that are needed. Always examine the specimen as soon as possible after it is passed. If the fecal material is already fluid, one has merely to allow it to settle in a conical glass for a while and then draw off some of the sediment in a pipette, spread it on a slide, cover with a coverslip and examine first with the low and then with the high-power lens. If the stool be formed, a small amount of it should be mixed thoroughly with enough water to render it fluid and then allowed to stand in a conical glass until the sediment has settled, when it is examined as already described; or else, eight to ten bits should be selected from different parts of the specimen, mixed with a little water on slides, covered with coverslips and examined. Do not be content with a single examination. At least six slides should be made from the same specimen before admitting that it is negative, and in cases of continued diarrhœa examinations should be made for several days.

The strongyloides stercoralis was first described in 1876 by Normand, who discovered it in the stools of French soldiers returning from Cochin China, who were suffering with diarrhœa. Later in the same year it was more fully described by Bavey. They both believed it to be the cause of the diarrhœa so common in Cochin China, and to which the name "Cochin China Diarrhœa" had been given by the Europeans. Next it was reported from the Island of Martinique by Chauvin. The first record of its occurrence in Europe was in 1880, when Perroncito described it in conjunction with the Anchylostoma duodenale in the men working on the St. Gothard tunnel. Cases have since been found in Brazil, Russia, Sicily, Italy, Egypt, Germany, Prussia and the Dutch Indies, showing the very wide distribution of the parasite. In 1901, the first case in America was described by Strong[1], who reported one from the Johns Hopkins Hospital. Later in the same year Thayer[2] reported that case and two additional cases from Baltimore. In 1903, Ohlmacher[3] reported one case; Price[4], one case; Moore[5], one case; Brown[6], three cases, two of which were in Porto Ricans; and Hall[7], one case in a Japanese ship's cook. Stiles, in discussing a paper read by Price before the American Medical Association in 1903, speaks of four additional cases being reported from Washington and three from California. Moore, in discussing the same paper, reports two additional cases from Texas. Summing up these cases, we find that 19 have been reported from America—at least three of which were probably contracted outside of the United States, leaving 16 true American cases. If there have been other cases reported, I have not been able to find reference to them in the literature at my command. I am led to report my three cases from Tennessee because of the fact that none have so far been recorded from this State and because I believe that it is important that the geographical distribution of this, as of all other intestinal parasites, should be learned as correctly and completely as possible.

The adult intestinal form of this worm is a parthenogenetic female, living chiefly in the duodenum, but also found to some extent in the jejunum. It is described by Normand as follows: "Length, 2.2 mm., average breadth, .03 mm., the body, a little tapering anteriorly, terminated rather suddenly posteriorly in a conical tail, the extremity of which appeared rounded and even a trifle dilated; * * * the surface showed a delicate transverse striation; the mouth * * * showed three small lips. It opened into an œsophagus, practically cylindrical, which occupied about one-fourth of the length of the animal, and showed neither swellings nor striations; it was followed by an intestine, with which it might readily be confounded, without a marked change in color. This extended almost to the posterior extremity of the body, but it ceased to be visible in the middle part, which was occupied by a very large, elongated ovary. The vulva was situated in the posterior third of the animal, and in its neighborhood the uterus contained five or six elongated eggs. * * * The eggs and viscera were of a yellowish green color and rather opaque and apparently finely granular."

The life cycle of this parasite is an interesting one. In the freshly-passed stool the adult worm and the ova are almost never found. Instead, we find numerous small active embryos about .3-.5 mm. long and 01.-.02 mm. broad. This is the rhabditiform stage. The change that will take place in the embryo outside of the body seems to depend upon whether it is in the temperate zone or in the tropics. In the tropics, the rhabditiform embryos soon develop into adult male and female worms, which are about 1 mm. long. The eggs laid by the females of this type hatch into another generation of rhabditiform embryos which, instead of going on to the adult sexually mature forms again, develop into a long, slender, filariform stage, the length of which is .5-.6 mm. In the temperate zone, the rhabditiform embryos, as found in the feces, are transformed directly into the filariform stage without first passing into the sexually mature worms. Apparently it is in the filariform stage that the parasite gains entrance to the body, where it is transformed into the adult parthenogenetic female. It has been shown that, if filariform embryos be fed to animals, rhabditiform embryos will appear in the stools in about seventeen days, and also the filariform embryos have never been observed to be transformed into the sexually differentiated type, so that we are led to assume that they are changed directly into the parthenogenetic female type. The life cycle in the temperate zones, then, is: The parthenogenetic mother worm deposits her eggs in the small intestine. These eggs hatch into the rhabditiform larvae, which are passed from the body in the stools and outside of the body develop in 3-5 days into the filariform embryos. These, being taken into the body, are transformed into the parthenogenetic mother worms and the cycle begins again. In the tropics, the parthenogenetic mother worm deposits her eggs in the intestine. From these hatch the rhabditiform larvae which are passed in the stools. Outside of the body, they develop into the sexually mature male and female worms, the latter of which lay their eggs and from them hatch a new generation of rhabditiform larvae. These in turn develop into the filariform embryos which, gaining entrance to the body, develop into the parthenogenetic mother worms.

The parasite is frequently found in association with other forms of intestinal parasites. Although Price seems to think that this is more than a mere coincidence, my belief is that it is purely coincidental. The majority of the cases reported thus far are from regions where infection with animal parasites occurs in a very large percentage of all the inhabitants, and it is but natural that we should frequently find other parasites associated with this one. In two of my cases, which come from a region where intestinal parasites seem to be of rather unusual occurrence, no other parasites were present. The third case, coming from Georgia, showed an associated amœba infection.

Pathology—Although the statement is to be found in books and monographs that this parasite is non-pathogenic to man, such does not seem to be the case. In the fatal cases that have been studied, pathologic changes have been found in the intestine around the site of the parasites in the crypts of Lieberkuhn, where they are usually found. Strong, in a careful study of the first American case, which was a fatal one, found that in the crypts of Lieberkuhn containing the parthenogentic mother worms, eggs or embryos, there was a thinning and more or less atrophy of the epithelial lining of the crypt. Around it was some small round cell infiltration and in the surounding epithelial cells there were evidences of some proliferation, as shown by the presence of karyokinetic figures in the nuclei. The changes in the intestines, however, do not seem extensive enough to account for the symptoms. Reasoning from analogy with other parasites, it is highly probable that this worm may produce a toxin which, being absorbed, produces the symptoms by its toxic action on the nervous system.

Infection—Infection may take place in one of two ways—either by the mouth, in drinking water or on green vegetables, or by the skin, as shown experimentally by Stiles. In the latter case, the embryos undoubtedly pass by the same route as proven by Loos beyond the possibility of a doubt to be the case in uncinaria (hook-worm) infection. The larva, getting into the skin through an abrasion, burrows down and gets into a vein. It is then carried through the heart to the lungs. Here it is stopped by the finer capillaries and, burrowing out into the air-cells, it crawls up the bronchioles, bronchi and trachea and finally over into the oesophagus and down through the stomach into the intestines. How long the worm may live in the intestine is not known. Reinfection within the intestine, as suggested by Ward, may possibly take place and account for the long duration of the infection and its obstinacy to treatment.

Symptoms—There may be no symptoms at all and this has led to the statement that the parasite is harmless. We know well, however, that with all intestinal parasites symptoms may be slight or absent at times. Slight degrees of infection with the uncinaria may produce no symptoms. Likewise, the presence of the ascaris and the trichocephalus may never be suspected from the clinical histories of some cases, and yet the first of these is markedly pathogenic and the other two are sometimes pathogenic. As a rule, the symptoms are those of a prolonged gastro-intestinal disturbance, the intestinal symptoms being predominant. The onset is usually gradual with diarrhœa, which may be continuous or may show periods of constipation alternating with diarrhœa. There is usually no pain and no griping, except in the severe cases. The movements vary in number, sometimes reaching twenty-five or more in the twenty-four hours. One very characteristic feature is an incontinence of the bowel. Even though the patient may not be having any marked diarrhœal symptoms, he may be suddenly seized with an uncontrollable desire to evacuate the bowels. The feces may be thin or of a formed pasty nature and occasionally contain a little mucus and, less frequently, a little blood. Neither the mucus nor the blood are ever present in large quantities. Fever is absent, as a rule. Anaemia also is not present, or only to a very slight degree. The blood examination gives us nothing characteristic.

The diagnosis of the condition is made by finding the rhabditiform embryos in the stools. In cases where there are enough parasites to cause symptoms, there are always large numbers of the parasites in the stools.

The prognosis depends upon the severity of the infection. In mild cases, the prognosis is good. In severe cases, it seems impossible to do anything to rid the bowel of the parasites.

The treatment is very unsatisfactory. Thymol, which is so valuable in the treatment of uncinaria infection, is a signal failure when used for the strongyloides. Male fern and the other anthelmintics also seem to be of no value.

CASES.

Case 1. Seen with Dr. E. G. Wood. L.A. D. Male. Age, 56. White.

Complaint. Irregular bowels and rheumatism.

History. Seven years ago contracted a chronic diarrhoea which lasted two summers. Since then bowels have been irregular, either constipation or diarrhoea. No griping, but some rectal burning and straining. Occasionally a little blood in the stools. Occasional vomiting, but appetite always good. Some shortness of breath on exertion and sometimes slight oedema of feet and ankles. Has lost 20-25 lbs. in past four years. Became a morphine habitue as a result of the free use of opium for the diarrhoea, and now uses 4-6 quarter grain doses hypodermically daily.

Examination. Emaciated. Moderate anaemia. Temperature and pulse normal. Chest negative. Abdomen—walls thin; intestinal coils visible; slight tenderness; organs not palpable. Examination of stools shows tremendous numbers of the rhabditiform embryos of the strongyloides stercoralis. Treatment with thymol failed to effect a cure.

Case 2. F.S. Male. Age, 24.

Complaint. Diarrhoea with great straining and blood and mucus in stools.

History. Always lived in Georgia up to six months ago. One year ago had an attack of dysentery with frequent evacuations containing much blood and mucus. The attack lasted about five weeks, during which time he was confined to his bed. Since then bowels have been fairly regular.

One week ago bowels began to "run off." There was much straining whenever they acted. Some blood and mucus was to be seen in the stools. There was slight abdominal pain and some fever at first.

Examination. Well nourished man. Slightly anaemic. Physical examination negative, except for slight abdominal tenderness. Examination of stools showed amoeba histolytica and also a moderate number of the rhabditiform embryos of the strongyloides stercoralis. This case probably originated in Georgia and not in Tennessee. Patient returned to Georgia, so no treatment was tried.

Case 3. Woman. Age, about 70.

Complaint. Shortness of breath, /swelling of feet and ankles and irregularity of the bowels.

History. Difficult to obtain any trustworthy statements. Seemed to have had no definite symptoms referable to the parasitic infection, except the irregularity of the bowels. Her other symptoms were referable to myocardial degeneration.

Examination. Nothing found on physical examination, except the signs of myocardial degeneration. Examination of the stools showed large numbers of the embryos of the Strongyloides stercoralis.

Treatment with thymol seemed to cause no diminution in the number of parasites.

LITERATURE.

1. Strong: Johns Hopkins Hospital Reports, Vol. X, Nos. 1 and 2.

2. Thayer: Jour. of Exper. Med. Vol. 1, No. 1, Page 75.

3. Ohlmacher: Amer. Med. 1903, Vol. V, Page 816.

4. Price: Jour. A.M.A. 1903, Vol. XLI, Page 651.

5. Moore: Amer. Med. 1903, Vol. VI, Page 876.

6. Brown: Bost. M. and S. Journal, 1903, May 28.

7. Hall: Jour. A. M. A., 1907, Vol. XLVIII, Page 1182.

*A DISCUSSION OF THE ACTIONS OF CERTAIN DRUGS ON BLOOD VESSELS

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In choosing the subject for discussion in this section (Materia Medica and Therapeutics),* the writer is of opinion that a brief review of the findings of modern experimental pharmacology, in regard to the most frequently used drugs acting on the vessels, will be of value. The present effort will be to summarize these findings and to point out wherein many old notions of physiological action and therapeutics, which have been handed down from generation to generation, are at variance with these findings. The advances in pharmacology are known to our students of medicine in schools of the first class, but are not within the reach of the average busy practitioner of medicine, for the reason that papers on this subject, if thoroughly scientific, are often too technical to be attractive reading to the average man, even if published in the journals which he reads. Again, certain textbooks which bear a recent date are responsible for the perpetuation of errors.

The drugs I have selected for discussion are those which are in the main, types of groups having the same or similar action. Grouped in this way it becomes easier to discuss each drug in comparison with the others.

VASO-CONSTRICTORS.

Drugs of this class act in one or more of the following ways: (1) Stimulation of vasomotor center; (2) stimulation of vaso-motor terminals; (3) stimulation of muscle fibers in walls of vessels themselves. There is no drug which can be demonstrated to produce a vasoconstrictor effect through a paralysis of vasodilator apparatus. Theoretically, this is a possibility, but no technic has yet been devised to prove such an action.

In order prove a vaso-constrictor or vasodilator effect from a drug, there are several methods of procedure. The web of a frog's foot, the mesentery or other transparent part may be observed with a microscope before and after giving the drug. A rise or a fall in blood pressure without any demonstrable primary effect on the heart-beat gives evidence of a constriction or a dilation of vessels, respectively. This is measureable by a pressure manometer. If we wish to exclude the effect of vaso-motor center we destroy the center or sever the connection with a particular organ or region and determine whether the effect is the same as before. In *apocodein* we have a drug which in doses that an animal can bear, paralyzes the entire nervous apparatus, excepting in respect to vessels, the fibers in which they terminate. If after giving apocodein we still get a vaso-constrictor effect, we can conclude that there is a stimulating effect on the smooth fibers of the vessel walls.

Perfusion of an amputated limb or excised organ with defibrinated blood or artificial serum, and the measuring of the venous return, or of the alteration of volume, constitutes a method of excluding action on centers. A positive proof of effect on vaso-motor center is the ligation of cerebral vessels and perfusion of the brain alone with the drug to be tested. Then if a constrictor effect is obtained we have no doubt as to the cause.

DIGITALIS GROUP.

Included under this head we have a large number of drugs of widely different origins and of radically different chemical constitution. In this group are found digitalis, strophanthus, squills, apocynum, convallaria, all of

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